

## 5. Conversion Tables

All quantities (mass, length, density, speed, force, pressure, energy, power) listed in these conversion tables can be ultimately expressed in the following three basic units:

M = mass,

L = length,

T = time.

### 5.1 Mass (M)

	gm	kg	lb <sub>m</sub>	slug
1 gram =	1	0.001	$2.205 \times 10^{-3}$	$6.852 \times 10^{-5}$
1 kilogram =	1000.0	1	2.205	$6.852 \times 10^{-2}$
1 pound <sub>m</sub> =	453.6	0.4536	1	$3.108 \times 10^{-2}$
1 slug =	$1.459 \times 10^4$	14.59	32.17	1

### 5.2 Length (L)

	cm	m	km	in	ft	mi
1 centimeter =	1	$1.0 \times 10^{-2}$	$1.0 \times 10^{-5}$	0.3937	$3.281 \times 10^{-2}$	$6.214 \times 10^{-6}$
1 meter =	100.0	1	$1.0 \times 10^{-3}$	39.37	3.281	$6.214 \times 10^{-4}$
1 kilometer =	$1.0 \times 10^5$	1000.0	1	$3.937 \times 10^4$	3281.0	0.6214
1 inch =	2.540	$2.540 \times 10^{-2}$	$2.540 \times 10^{-5}$	1	$8.33 \times 10^{-2}$	$1.578 \times 10^{-5}$
1 foot =	30.48	0.3048	$3.048 \times 10^{-4}$	12	1	$1.894 \times 10^{-4}$
1 mile =	$1.609 \times 10^5$	1609.0	1.609	$6.336 \times 10^4$	5280.0	1

1 foot = $\frac{1200}{3937}$ meter	1 millimicron ( $m_\mu$ ) = $10^{-9}$ m	1 yard = 3 ft
1 meter = $\frac{3937}{1200}$ feet	1 light-year = $9.4600 \times 10^{12}$ km	1 rod = 16.5 ft
1 angstrom (A) = $10^{-10}$ m	1 parsec = $3.084 \times 10^{13}$ km	1 mil = $10^{-3}$ in
1 micron ( $\mu$ ) = $10^{-6}$ m	1 fathom = 6 ft	
1 nautical mile = 1852m = 1.1508 statute miles = 6076.10 ft		

### 5.3 Density ( $ML^{-3}$ )

	slug/ft <sup>3</sup>	lb <sub>m</sub> /ft <sup>3</sup>	lb <sub>m</sub> /in <sup>3</sup>	kg/m <sup>3</sup>	g/cm <sup>3</sup>
1 slug per ft <sup>3</sup> =	1	32.17	$1.862 \times 10^{-2}$	515.4	0.5154
1 pound <sub>m</sub> per ft <sup>3</sup> =	$3.108 \times 10^{-2}$	1	$5.787 \times 10^{-4}$	16.02	$1.602 \times 10^{-2}$
1 pound <sub>m</sub> per in <sup>3</sup> =	53.71	1728.0	1	$2.768 \times 10^4$	27.68
1 kilogram per m <sup>3</sup> =	$1.940 \times 10^{-3}$	$6.243 \times 10^{-2}$	$3.613 \times 10^{-5}$	1	0.001
1 gram per cm <sup>3</sup> =	1.940	62.43	$3.613 \times 10^{-2}$	1000.00	1

### 5.4 Speed ( $MT^{-1}$ )

	ft/sec	km/hr	m/sec	mi/hr	knot
1 foot per second =	1	1.097	0.3048	0.6818	0.5925
1 kilometer per hour =	0.9113	1	0.2778	0.6214	0.5400
1 meter per second =	3.281	3.6	1	2.237	1.944
1 mile per hour =	1.467	1.609	0.4470	1	0.8689
1 knot =	1.688	1.852	0.5144	1.151	1
1 knot = 1 nautical mile/hr		1 mi/min = 88 ft/sec = 60 mi/hr			

**5.5 Force (MLT<sup>-2</sup>)**

	dyne	gf	kgf	nt	lbf
1 dyne =	1	$1.020 \times 10^{-3}$	$1.020 \times 10^{-6}$	$1.0 \times 10^{-5}$	$2.248 \times 10^{-6}$
1 gram-force =	980.7	1	0.001	$9.807 \times 10^{-3}$	$2.205 \times 10^{-3}$
1 kilogram-force =	$9.807 \times 10^5$	1000.0	1	9.807	2.205
1 newton =	$1.0 \times 10^5$	102.0	0.1020	1	0.2248
1 pound <sub>f</sub> =	$4.448 \times 10^5$	453.6	0.4536	4.448	1

**5.6 Pressure (ML<sup>-1</sup>T<sup>-2</sup>)**

	atm	dyne/ cm <sup>2</sup>	inch of water	in Hg	kgf/m <sup>2</sup>	nt/m <sup>2</sup>	lbf/in <sup>2</sup>	lbf/ft <sup>2</sup>
1 atmosphere =	1	$1.013 \times 10^6$	406.8	29.92	$1.033 \times 10^4$	$1.013 \times 10^5$	14.696	2116.0
1 dyne per cm <sup>2</sup> =	$9.869 \times 10^{-7}$	1	$4.015 \times 10^{-4}$	$2.953 \times 10^{-5}$	$1.020 \times 10^{-2}$	0.1	$1.450 \times 10^{-5}$	$2.089 \times 10^{-3}$
1 inch of water at 4°C *	$2.458 \times 10^{-3}$	2491.0	1	$7.354 \times 10^{-2}$	25.40	249.1	$3.613 \times 10^{-2}$	5.202
1 inch of mercury at 0° C*	$3.343 \times 10^{-2}$	$3.386 \times 10^4$	13.597	1	345.4	$3.386 \times 10^3$	0.4912	70.74
1 kilogram-force per m <sup>2</sup> =	$9.678 \times 10^{-5}$	98.07	$3.937 \times 10^{-2}$	$2.896 \times 10^{-3}$	1	9.807	$1.422 \times 10^{-3}$	0.2048
1 newton per m <sup>2</sup> =	$9.869 \times 10^{-6}$	10.0	$4.015 \times 10^{-3}$	$2.953 \times 10^{-4}$	0.1020	1	$1.450 \times 10^{-4}$	$2.089 \times 10^{-2}$
1 pound <sub>f</sub> per in <sup>2</sup> =	$6.805 \times 10^{-2}$	$6.895 \times 10^4$	27.68	2.036	703.1	$6.895 \times 10^3$	1	144.0
1 pound <sub>f</sub> per ft <sup>2</sup> =	$4.725 \times 10^{-4}$	478.8	0.1922	$1.414 \times 10^{-2}$	4.882	47.88	$6.944 \times 10^{-3}$	1

\* Where the acceleration of gravity has the standard value 9.80556 m/sec<sup>2</sup>.

**5.7 Energy, Work, Heat (ML<sup>2</sup>T<sup>-2</sup>)**

	BTU	erg	ft-lb <sub>f</sub>	hp-hr	joule	kcal	kwh
1 British thermal unit =	1	1.055 $\times 10^{10}$	777.9	3.929 $\times 10^{-4}$	1055.0	0.2520	2.930 $\times 10^{-4}$
1 erg =	9.481 $\times 10^{-11}$	1	7.376 $\times 10^{-8}$	3.725 $\times 10^{-14}$	1.0 $\times 10^{-7}$	2.389 $\times 10^{-11}$	2.778 $\times 10^{-14}$
1 foot pound <sub>f</sub> =	1.285 $\times 10^{-3}$	1.356 $\times 10^7$	1	5.051 $\times 10^{-7}$	1.356	3.239 $\times 10^{-4}$	3.766 $\times 10^{-7}$
1 horsepower hour =	2545.0	2.685 $\times 10^{13}$	1.980 $\times 10^6$	1	2.685 $\times 10^6$	641.4	0.7457
1 joule =	9.481 $\times 10^{-4}$	1.0 $\times 10^7$	0.7376	3.725 $\times 10^{-7}$	1	2.389 $\times 10^{-4}$	2.778 $\times 10^{-7}$
1 kilocalorie =	3.968	4.186 $\times 10^{10}$	3087.0	1.559 $\times 10^{-3}$	4186	1	1.163 $\times 10^{-3}$
1 kilowatt hour =	3413.0	3.6 $\times 10^{13}$	2.655 $\times 10^6$	1.341	3.6 $\times 10^6$	860.1	1

**5.8 Power ( $ML^2T^{-3}$ )**

	BTU/ hr	ft.lbf/ min	ft lbf/ sec	hp	kcal/ sec	kw	w
1 British thermal unit per hour =	1	12.97	0.2161	$3.929 \times 10^{-4}$	$7.000 \times 10^{-5}$	$2.930 \times 10^{-4}$	0.2930
1 foot pound <sub>f</sub> per minute =	$7.713 \times 10^{-2}$	1	$1.667 \times 10^{-2}$	$3.030 \times 10^{-5}$	$5.399 \times 10^{-6}$	$2.260 \times 10^{-5}$	$2.260 \times 10^{-2}$
1 foot pound <sub>f</sub> per second =	4.628	60.0	1	$1.818 \times 10^{-3}$	$3.239 \times 10^{-4}$	$1.356 \times 10^{-3}$	1.356
1 horsepower =	2545.0	$3.3 \times 10^4$	550.0	1	0.1782	0.7457	745.7
1 kilocalorie per second =	$1.429 \times 10^4$	$1.852 \times 10^5$	3087.0	5.613	1	4.186	4186.0
1 kilowatt =	$3.413 \times 10^3$	$4.425 \times 10^4$	737.6	1.341	0.2389	1	1000
1 watt =	3.413	44.25	0.7376	$1.341 \times 10^{-3}$	$2.389 \times 10^{-4}$	0.001	1